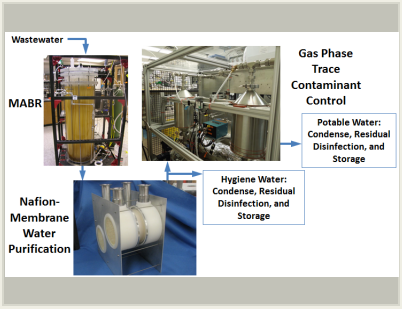
Small Business Innovation Research/Small Business Tech Transfer

Development of the Integrated Water Recovery Assembly (IRA) for Recycling Habitation Wastewater Stre, Phase I

Completed Technology Project (2016 - 2017)

Project Introduction

Paragon Space Development Corporation and our partner Research Institution Texas Tech University (TTU) propose to develop a spacecraft habitat wastewater recycling system that integrates 1) the TTU Membrane Aerated Biological Reactor (MABR), 2) Nafion Membrane Water Purification (NWP) distillation technology, and 3) gas-phase trace contaminant removal to realize a low-mass, low-volume, closed-loop, sustainable, and ultra-reliable water recycling and purification system. It is the coupling of these three well developed and understood processes that is novel and offers a significant advantage over state of the art (SOA) spacecraft water processing systems. The Integrated Water Recovery Assembly (IRA) will reduce consumable consumption by removing the need for hazardous chemical pretreat and likely eliminate the need for aqueous-phase treatment now used to reach potable standards. It will also significantly reduce waste generation and increase material recycling by converting carbon, hydrogen, and nitrogen species into useful products such as H2O, N2, and CO2. IRA will be less complex, require fewer consumables, be more robust, and more sustainable than SOA systems. IRA will also produce a concentrated and dried solid waste stream that is always contained and that will consist of salts and residual organic matter. MABR and NWP have developed as independent subcomponents for human spaceflight wastewater processing but their unique attributes have not been optimized to function together as an integrated wastewater recycling system. Neither is individually capable of producing potable water, but combined with gas phase trace contaminant control, we propose that IRA represents a significant advancement over SOA of the art spacecraft wastewater processing systems. In summary, the innovation we propose is to combine and optimize all three stages into a novel integrated system capable of processing habitation wastewater and producing clean water for all habitat needs.



DEVELOPMENT OF THE INTEGRATED WATER RECOVERY ASSEMBLY (IRA) FOR RECYCLING HABITATION WASTEWATER STREAMS, Phase I

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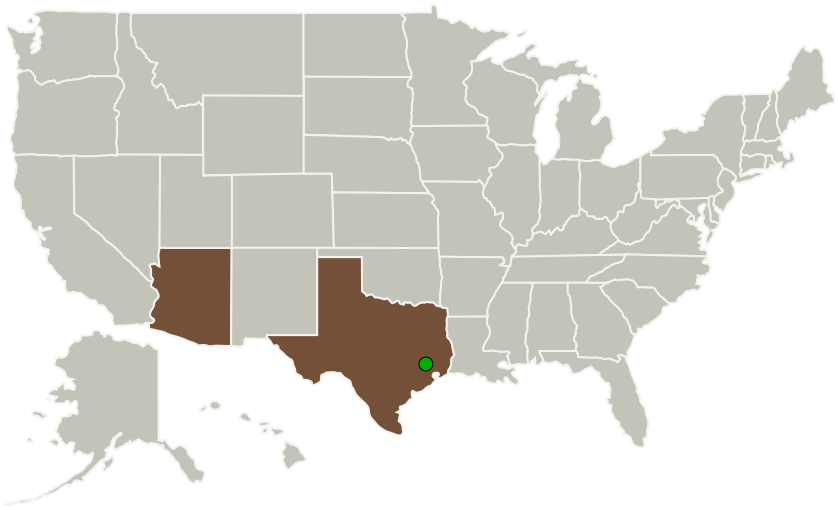
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Paragon Space Development Corporation	Lead Organization	Industry	Tucson, Arizona
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas
Texas Tech University	Supporting Organization	Academia	Lubbock, Texas

Primary U.S. Work Locations	
Arizona	Texas

Project Transitions

June 2016: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Paragon Space Development Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

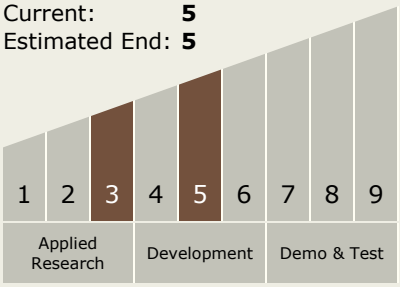
Carlos Torrez

Co-Investigator:

Barry W Finger

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Development of the Integrated Water Recovery Assembly (IRA) for Recycling Habitation Wastewater Stre, Phase I

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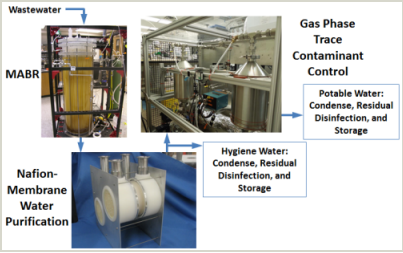
June 2017: Closed out

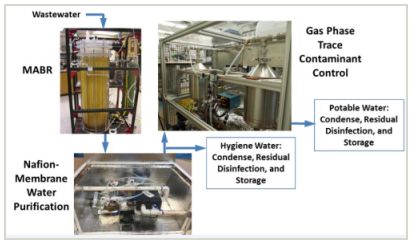
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141013)*

Images



Briefing Chart Image
DEVELOPMENT OF THE INTEGRATED WATER RECOVERY ASSEMBLY (IRA) FOR RECYCLING HABITATION WASTEWATER STREAMS, Phase I *(https://techport.nasa.gov/image/127340)*



Final Summary Chart Image
DEVELOPMENT OF THE INTEGRATED WATER RECOVERY ASSEMBLY (IRA) FOR RECYCLING HABITATION WASTEWATER STREAMS, Phase I Project Image *(https://techport.nasa.gov/image/130793)*

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.2 Water Recovery and Management

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System